

## SEQUENCE LISTING

<110> Kaslow, David C.  
 Tsuboi, Takafumi  
 Torii, Motomi  
 The Government of the United States of America  
 as represented by the Secretary of the  
 Department of Health and Human Services

<120> Vaccines for Blocking Transmission of Plasmodium vivax

<130> 015280-34210US

<140> US 09/554,960  
 <141> 2003-02-12

<150> US 60/045,283  
 <151> 1997-05-01

<150> WO PCT/US98/25742  
 <151> 1998-12-04

<160> 24

<170> PatentIn Ver. 2.0

<210> 1  
 <211> 1066  
 <212> DNA  
 <213> Plasmodium vivax

<220>  
 <221> CDS  
 <222> (147)..(857)  
 <223> Pvs28

<400> 1  
 tccactcctc tcttgttcca cactttatct ttgtttcccc ccattcggcc accaactgca 60  
 ttatacaaaa acgactcccc ctttgagata acacccaact gagctcgatt cccctcccc 120  
 acttttgcgc ctcccccttg ttcaaa atg aat acc tac cac agc ttg ctg ttc 173  
 Met Asn Thr Tyr His Ser Leu Leu Phe  
 1 5

ctt ctg gcc atc gtg ctt act gtt aag cac acc ttc gca aag gtc acc 221  
 Leu Leu Ala Ile Val Leu Thr Val Lys His Thr Phe Ala Lys Val Thr  
 10 15 20 25

gcg gag acc caa tgc aaa aat ggc tat gta gtc caa atg agc aat cat 269  
 Ala Glu Thr Gln Cys Lys Asn Gly Tyr Val Val Gln Met Ser Asn His  
 30 35 40

ttt gaa tgc aaa tgc aac gac ggg ttt gtt atg gca aat gaa aac act 317  
 Phe Glu Cys Lys Cys Asn Asp Gly Phe Val Met Ala Asn Glu Asn Thr  
 45 50 55

tgc gag gaa aaa cgc gat tgc aca aat cca caa aat gta aat aaa aac 365  
 Cys Glu Glu Lys Arg Asp Cys Thr Asn Pro Gln Asn Val Asn Lys Asn  
 60 65 70

tgt gga gac tac gct gtg tgt gca aac acc aga atg aat gat gag gaa 413  
 Cys Gly Asp Tyr Ala Val Cys Ala Asn Thr Arg Met Asn Asp Glu Glu  
 75 80 85

aga gca tta cga tgc ggc tgc ata tta ggg tac acc gta atg aat gag 461  
 Arg Ala Leu Arg Cys Gly Cys Ile Leu Gly Tyr Thr Val Met Asn Glu  
 90 95 100 105

gtg tgt act cca aat aaa tgt aac ggc gtt ttg tgt gga aag gga aag 509  
 Val Cys Thr Pro Asn Lys Cys Asn Gly Val Leu Cys Gly Lys Gly Lys  
 110 115 120

tgc atc tta gat ccc gct aat gtg aac agc acc atg tgc tct tgt aat 557  
 Cys Ile Leu Asp Pro Ala Asn Val Asn Ser Thr Met Cys Ser Cys Asn  
 125 130 135

ata gga acc aca ttg gat gaa tct aaa aaa tgt gga aag cca gga aaa 605  
 Ile Gly Thr Thr Leu Asp Glu Ser Lys Lys Cys Gly Lys Pro Gly Lys  
 140 145 150

act gaa tgc acg ttg aag tgt aag gca aac gaa gaa tgt aaa gag act 653  
 Thr Glu Cys Thr Leu Lys Cys Lys Ala Asn Glu Glu Cys Lys Glu Thr  
 155 160 165

cag aat tat tac aag tgc gtt gcg aag gga agc ggc gga gaa ggc agc 701  
 Gln Asn Tyr Tyr Lys Cys Val Ala Lys Gly Ser Gly Gly Glu Gly Ser  
 170 175 180 185

ggt gga gaa ggc agc ggc gga gag ggc agc ggc gga gag ggc agc ggc 749  
 Gly Gly Glu Gly Ser Gly Gly Glu Gly Ser Gly Gly Glu Gly Ser Gly  
 190 195 200

gga gag ggc agc ggt gga gac aca gga gca gct tac agt ctc atg aac 797  
 Gly Glu Gly Ser Gly Gly Asp Thr Gly Ala Ala Tyr Ser Leu Met Asn  
 205 210 215

gga tct gca gta atc agc ata cta ctt gta ttc gcc ttc ttc atg atg 845  
 Gly Ser Ala Val Ile Ser Ile Leu Leu Val Phe Ala Phe Phe Met Met  
 220 225 230

tca tta gtg tagacgattc tacacacaca cacaacata cacaagggga 894  
 Ser Leu Val  
 235

gaagcgtctc acagagtcag ttcaagtcac acgcacaaaa aaggaaagta catccagctg 954

gtgaaagagc atttatgtgt gcagttatcc ttgggagaag caccctccac ccagttgcgt 1014

tgctgttacc ttaaaactta gtggcaccca tatcgaatct gactttgctc gc 1066

<210> 2  
 <211> 236  
 <212> PRT  
 <213> Plasmodium vivax

<400> 2  
 Met Asn Thr Tyr His Ser Leu Leu Phe Leu Leu Ala Ile Val Leu Thr  
 1 5 10 15

Val Lys His Thr Phe Ala Lys Val Thr Ala Glu Thr Gln Cys Lys Asn  
                     20                    25                    30  
 Gly Tyr Val Val Gln Met Ser Asn His Phe Glu Cys Lys Cys Asn Asp  
                     35                    40                    45  
 Gly Phe Val Met Ala Asn Glu Asn Thr Cys Glu Glu Lys Arg Asp Cys  
                     50                    55                    60  
 Thr Asn Pro Gln Asn Val Asn Lys Asn Cys Gly Asp Tyr Ala Val Cys  
                     65                    70                    75                    80  
 Ala Asn Thr Arg Met Asn Asp Glu Glu Arg Ala Leu Arg Cys Gly Cys  
                     85                    90                    95  
 Ile Leu Gly Tyr Thr Val Met Asn Glu Val Cys Thr Pro Asn Lys Cys  
                     100                    105                    110  
 Asn Gly Val Leu Cys Gly Lys Gly Lys Cys Ile Leu Asp Pro Ala Asn  
                     115                    120                    125  
 Val Asn Ser Thr Met Cys Ser Cys Asn Ile Gly Thr Thr Leu Asp Glu  
                     130                    135                    140  
 Ser Lys Lys Cys Gly Lys Pro Gly Lys Thr Glu Cys Thr Leu Lys Cys  
                     145                    150                    155                    160  
 Lys Ala Asn Glu Glu Cys Lys Glu Thr Gln Asn Tyr Tyr Lys Cys Val  
                     165                    170                    175  
 Ala Lys Gly Ser Gly Gly Glu Gly Ser Gly Gly Glu Gly Ser Gly Gly  
                     180                    185                    190  
 Glu Gly Ser Gly Gly Glu Gly Ser Gly Gly Glu Gly Ser Gly Gly Asp  
                     195                    200                    205  
 Thr Gly Ala Ala Tyr Ser Leu Met Asn Gly Ser Ala Val Ile Ser Ile  
                     210                    215                    220  
 Leu Leu Val Phe Ala Phe Phe Met Met Ser Leu Val  
                     225                    230                    235

<210> 3  
 <211> 995  
 <212> DNA  
 <213> Plasmodium vivax

<220>  
 <221> CDS  
 <222> (255)..(914)  
 <223> Pvs25

<400> 3  
 ctgacttttcg tttcacagca ctgatttttt tgttcgaccg ctcaattcgc cacttgccat 60  
 tttcgattgt ttgcttggtt gcttttttgc ttattcgccc gtttttccgc ttgcccgttc 120  
 gcccgtcca caacgcgccg ctgcaaaggt tgcccaccac cgaccacaaa aacttattca 180  
 ccaccatccg agcggaaagg aacgccgccc actgtgctgc ctacctcccc gaataacaac 240

ttccacttagc	caaa	atg	aac	tcc	tac	tac	agc	ctc	ttc	gtt	ttt	ttc	ctc	290		
		Met	Asn	Ser	Tyr	Tyr	Ser	Leu	Phe	Val	Phe	Phe	Leu			
		1				5					10					
gtc	caa	att	gcg	cta	aag	tat	agc	aag	gca	gcc	gtc	acg	gta	gac	acc	338
Val	Gln	Ile	Ala	Leu	Lys	Tyr	Ser	Lys	Ala	Ala	Val	Thr	Val	Asp	Thr	
		15				20					25					
ata	tgc	aaa	aat	gga	cag	ctg	gtt	caa	atg	agt	aac	cac	ttt	aag	tgt	386
Ile	Cys	Lys	Asn	Gly	Gln	Leu	Val	Gln	Met	Ser	Asn	His	Phe	Lys	Cys	
		30				35					40					
atg	tgt	aac	gaa	ggg	ctg	gtg	cac	ctt	tcc	gaa	aat	aca	tgt	gaa	gaa	434
Met	Cys	Asn	Glu	Gly	Leu	Val	His	Leu	Ser	Glu	Asn	Thr	Cys	Glu	Glu	
		45			50					55					60	
aaa	aat	gaa	tgc	aag	aaa	gaa	acc	cta	ggc	aaa	gca	tgc	ggg	gaa	ttt	482
Lys	Asn	Glu	Cys	Lys	Lys	Glu	Thr	Leu	Gly	Lys	Ala	Cys	Gly	Glu	Phe	
				65					70					75		
ggc	cag	tgt	ata	gaa	aac	cca	gac	cca	gca	cag	gta	aac	atg	tac	aaa	530
Gly	Gln	Cys	Ile	Glu	Asn	Pro	Asp	Pro	Ala	Gln	Val	Asn	Met	Tyr	Lys	
			80					85					90			
tgt	ggt	tgc	att	gag	ggc	tac	act	ttg	aag	gaa	gac	act	tgt	gtg	ctt	578
Cys	Gly	Cys	Ile	Glu	Gly	Tyr	Thr	Leu	Lys	Glu	Asp	Thr	Cys	Val	Leu	
		95				100						105				
gat	gta	tgt	caa	tac	aaa	aat	tgt	gga	gaa	agt	ggc	gaa	tgc	att	gtt	626
Asp	Val	Cys	Gln	Tyr	Lys	Asn	Cys	Gly	Glu	Ser	Gly	Glu	Cys	Ile	Val	
		110				115					120					
gag	tac	ctc	tcg	gaa	atc	caa	agt	gca	ggt	tgc	tca	tgt	gct	att	ggc	674
Glu	Tyr	Leu	Ser	Glu	Ile	Gln	Ser	Ala	Gly	Cys	Ser	Cys	Ala	Ile	Gly	
		125			130					135					140	
aaa	gtc	ccc	aat	cca	gaa	gat	gag	aaa	aaa	tgt	acc	aaa	acg	gga	gaa	722
Lys	Val	Pro	Asn	Pro	Glu	Asp	Glu	Lys	Lys	Cys	Thr	Lys	Thr	Gly	Glu	
				145					150					155		
act	gct	tgt	caa	ttg	aaa	tgt	aac	aca	gat	aat	gaa	gtc	tgc	aaa	aat	770
Thr	Ala	Cys	Gln	Leu	Lys	Cys	Asn	Thr	Asp	Asn	Glu	Val	Cys	Lys	Asn	
			160					165					170			
gtt	gaa	gga	gtt	tac	aag	tgc	cag	tgt	atg	gaa	ggc	ttt	acg	ttc	gac	818
Val	Glu	Gly	Val	Tyr	Lys	Cys	Gln	Cys	Met	Glu	Gly	Phe	Thr	Phe	Asp	
		175				180						185				
aaa	gag	aaa	aat	gta	tgc	ctt	tcc	tat	tct	gta	ttt	aac	atc	cta	aac	866
Lys	Glu	Lys	Asn	Val	Cys	Leu	Ser	Tyr	Ser	Val	Phe	Asn	Ile	Leu	Asn	
		190				195					200					
tac	tcc	ctc	ttc	ttt	atc	atc	ctg	ctt	gtc	ctt	tcg	tac	gtc	ata		911
Tyr	Ser	Leu	Phe	Phe	Ile</											

<210> 4  
 <211> 219  
 <212> PRT  
 <213> Plasmodium vivax

<400> 4  
 Met Asn Ser Tyr Tyr Ser Leu Phe Val Phe Phe Leu Val Gln Ile Ala  
   1                  5                  10                  15  
 Leu Lys Tyr Ser Lys Ala Ala Val Thr Val Asp Thr Ile Cys Lys Asn  
                   20                  25                  30  
 Gly Gln Leu Val Gln Met Ser Asn His Phe Lys Cys Met Cys Asn Glu  
                   35                  40                  45  
 Gly Leu Val His Leu Ser Glu Asn Thr Cys Glu Glu Lys Asn Glu Cys  
                   50                  55                  60  
 Lys Lys Glu Thr Leu Gly Lys Ala Cys Gly Glu Phe Gly Gln Cys Ile  
   65                  70                  75                  80  
 Glu Asn Pro Asp Pro Ala Gln Val Asn Met Tyr Lys Cys Gly Cys Ile  
                   85                  90                  95  
 Glu Gly Tyr Thr Leu Lys Glu Asp Thr Cys Val Leu Asp Val Cys Gln  
                   100                  105                  110  
 Tyr Lys Asn Cys Gly Glu Ser Gly Glu Cys Ile Val Glu Tyr Leu Ser  
                   115                  120                  125  
 Glu Ile Gln Ser Ala Gly Cys Ser Cys Ala Ile Gly Lys Val Pro Asn  
   130                  135                  140  
 Pro Glu Asp Glu Lys Lys Cys Thr Lys Thr Gly Glu Thr Ala Cys Gln  
 145                  150                  155                  160  
 Leu Lys Cys Asn Thr Asp Asn Glu Val Cys Lys Asn Val Glu Gly Val  
                   165                  170                  175  
 Tyr Lys Cys Gln Cys Met Glu Gly Phe Thr Phe Asp Lys Glu Lys Asn  
                   180                  185                  190  
 Val Cys Leu Ser Tyr Ser Val Phe Asn Ile Leu Asn Tyr Ser Leu Phe  
                   195                  200                  205  
 Phe Ile Ile Leu Leu Val Leu Ser Tyr Val Ile  
   210                  215

<210> 5  
 <211> 377  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> Description of Artificial Sequence:Pvs25-Pvs28  
           fusion protein

<400> 5  
 Ala Val Thr Val Asp Thr Ile Cys Lys Asn Gly Gln Leu Val Gln Met  
   1                  5                  10                  15

Ser	Asn	His	Phe	Lys	Cys	Met	Cys	Asn	Glu	Gly	Leu	Val	His	Leu	Ser	20	25	30
Glu	Asn	Thr	Cys	Glu	Glu	Lys	Asn	Glu	Cys	Lys	Lys	Glu	Thr	Leu	Gly	35	40	45
Lys	Ala	Cys	Gly	Glu	Phe	Gly	Gln	Cys	Ile	Glu	Asn	Pro	Asp	Pro	Ala	50	55	60
Gln	Val	Asn	Met	Tyr	Lys	Cys	Gly	Cys	Ile	Glu	Gly	Tyr	Thr	Leu	Lys	65	70	75
Glu	Asp	Thr	Cys	Val	Leu	Asp	Val	Cys	Gln	Tyr	Lys	Asn	Cys	Gly	Glu	85	90	95
Ser	Gly	Glu	Cys	Ile	Val	Glu	Tyr	Leu	Ser	Glu	Ile	Gln	Ser	Ala	Gly	100	105	110
Cys	Ser	Cys	Ala	Ile	Gly	Lys	Val	Pro	Asn	Pro	Glu	Asp	Glu	Lys	Lys	115	120	125
Cys	Thr	Lys	Thr	Gly	Glu	Thr	Ala	Cys	Gln	Leu	Lys	Cys	Asn	Thr	Asp	130	135	140
Asn	Glu	Val	Cys	Lys	Asn	Val	Glu	Gly	Val	Tyr	Lys	Cys	Gln	Cys	Met	145	150	155
Glu	Gly	Phe	Thr	Phe	Asp	Lys	Glu	Lys	Asn	Val	Cys	Leu	Ser	Gly	Gly	165	170	175
Gly	Pro	Gly	Gly	Gly	Ala	Lys	Val	Thr	Ala	Glu	Thr	Gln	Cys	Lys	Asn	180	185	190
Gly	Tyr	Val	Val	Gln	Met	Ser	Asn	His	Phe	Glu	Cys	Lys	Cys	Asn	Asp	195	200	205
Gly	Phe	Val	Met	Ala	Asn	Glu	Asn	Thr	Cys	Glu	Glu	Lys	Arg	Asp	Cys	210	215	220
Thr	Asn	Pro	Gln	Asn	Val	Asn	Lys	Asn	Cys	Gly	Asp	Tyr	Ala	Val	Cys	225	230	235
Ala	Asn	Thr	Arg	Met	Asn	Asp	Glu	Glu	Arg	Ala	Leu	Arg	Cys	Gly	Cys	245	250	255
Ile	Leu	Gly	Tyr	Thr	Val	Met	Asn	Glu	Val	Cys	Thr	Pro	Asn	Lys	Cys	260	265	270
Asn	Gly	Val	Leu	Cys	Gly	Lys	Gly	Lys	Cys	Ile	Leu	Asp	Pro	Ala	Asn	275	280	285
Val	Asn	Ser	Thr	Met	Cys	Ser	Cys	Asn	Ile	Gly	Thr	Thr	Leu	Asp	Glu	290	295	300
Ser	Lys	Lys	Cys	Gly	Lys	Pro	Gly	Lys	Thr	Glu	Cys	Thr	Leu	Lys	Cys	305	310	315
Lys	Ala	Asn	Glu	Glu	Cys	Lys	Glu	Thr	Gln	Asn	Tyr	Tyr	Lys	Cys	Val	325	330	335

Ala Lys Gly Ser Gly Gly Glu Gly Ser Gly Gly Glu Gly Ser Gly Gly  
                   340                  345                  350

Glu Gly Ser Gly Gly Glu Gly Ser Gly Gly Glu Gly Ser Gly Gly Asp  
           355                  360                  365

Thr Gly Ala Ala Tyr Ser Leu Met Asn  
       370                  375

<210> 6

<211> 21

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:sense primer

<400> 6

ggwtttytrr ytcaratgag t

21

<210> 7

<211> 17

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:vector-specific  
           M13 universal primer

<400> 7

gtaaaacgac ggccagt

17

<210> 8

<211> 24

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:internal  
           degenerate sense primer

<400> 8

tcaratgagt rrycatttdg aatg

24

<210> 9

<211> 25

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:PCR-sense  
           splinkerette #1 primer

<400> 9

cgaatcgtaa ccgttcgtac gagaa

25

<210> 10  
 <211> 20  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence:antisense Pvs25  
         specific primer  
  
 <400> 10  
 ggacaagcag gatgataaag 20  
  
 <210> 11  
 <211> 25  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence:nested PCR  
         sense splinkerette #2 internal primer  
  
 <400> 11  
 tcgtaccaga atcgctgtcc tctcc 25  
  
 <210> 12  
 <211> 21  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence:anti-sense  
         Pvs25 specific internal primer  
  
 <400> 12  
 agcacacaag tgtcttcctt c 21  
  
 <210> 13  
 <211> 18  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence:gene specific  
         PCR sense primer  
  
 <400> 13  
 actttcgttt cacagcac 18  
  
 <210> 14  
 <211> 20  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence:gene specific  
         PCR anti-sense primer



<400> 14  
aaaggacaag caggatgata

20

<210> 15  
<211> 7  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:flexible linker

<400> 15  
Gly Gly Gly Pro Gly Gly Gly  
1 5

<210> 16  
<211> 186  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:Pvs25 fusion  
protein

<400> 16  
Glu Ala Glu Ala Ser Ala Val Thr Val Asp Thr Ile Cys Lys Asn Gly  
1 5 10 15  
Gln Leu Val Gln Met Ser Asn His Phe Lys Cys Met Cys Asn Glu Gly  
20 25 30  
Leu Val His Leu Ser Glu Asn Thr Cys Glu Glu Lys Asn Glu Cys Lys  
35 40 45  
Lys Glu Thr Leu Gly Lys Ala Cys Gly Glu Phe Gly Gln Cys Ile Glu  
50 55 60  
Asn Pro Asp Pro Ala Gln Val Asn Met Tyr Lys Cys Gly Cys Ile Glu  
65 70 75 80  
Gly Tyr Thr Leu Lys Glu Asp Thr Cys Val Leu Asp Val Cys Gln Tyr  
85 90 95  
Lys Asn Cys Gly Glu Ser Gly Glu Cys Ile Val Glu Tyr Leu Ser Glu  
100 105 110  
Ile Gln Ser Ala Gly Cys Ser Cys Ala Ile Gly Lys Val Pro Glu Pro  
115 120 125  
Glu Asp Glu Lys Lys Cys Thr Lys Thr Gly Glu Thr Ala Cys Gln Leu  
130 135 140  
Lys Cys Asn Thr Asp Asn Glu Val Cys Lys Asn Val Glu Gly Val Tyr  
145 150 155 160  
Lys Cys Gln Cys Met Glu Gly Phe Thr Phe Cys Lys Glu Lys Asn Val  
165 170 175

Cys Leu Gly Pro His His His His His His  
                   180                                  185

<210> 17  
 <211> 205  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> Description of Artificial Sequence:Pvs28 fusion  
           protein

<400> 17  
 Glu Ala Glu Ala Ser Lys Val Thr Ala Glu Thr Gln Cys Lys Asn Gly  
   1                  5                                  10                                  15  
 Tyr Val Val Gln Met Ser Asn His Phe Glu Cys Lys Cys Asn Asp Gly  
                   20                                  25                                  30  
 Phe Val Leu Ala Asn Glu Asn Thr Cys Glu Glu Lys Arg Asp Cys Thr  
                   35                                  40                                  45  
 Asn Pro Gln Asn Val Asn Lys Asn Cys Gly Asp Tyr Ala Val Cys Ala  
                   50                                  55                                  60  
 Asn Thr Arg Met Asn Asn Glu Glu Arg Ala Leu Arg Cys Gly Cys Ile  
   65                                  70                                  75                                  80  
 Leu Gly Tyr Thr Val Met Asn Glu Val Cys Thr Pro Tyr Lys Cys Asn  
                   85                                  90                                  95  
 Gly Val Leu Cys Gly Lys Gly Lys Cys Ile Leu Asp Pro Ala Asn Val  
                   100                                  105                                  110  
 Asn Ser Thr Met Cys Ser Cys Asn Ile Gly Ser Thr Leu Asp Glu Ser  
                   115                                  120                                  125  
 Lys Lys Cys Gly Lys Pro Gly Lys Thr Glu Cys Thr Leu Lys Cys Lys  
                   130                                  135                                  140  
 Ala Asn Glu Glu Cys Lys Glu Thr Gln Asn Tyr Tyr Lys Cys Val Ala  
   145                                  150                                  155                                  160  
 Lys Gly Ser Gly Gly Glu Gly Ser Gly Gly Glu Gly Ser Gly Gly Glu  
                   165                                  170                                  175  
 Gly Ser Gly Gly Glu Gly Ser Gly Gly Glu Gly Ser Gly Gly Asp Thr  
                   180                                  185                                  190  
 Gly Ala Ala Tyr Ser Gly Pro His His His His His His  
                   195                                  200                                  205

<210> 18  
 <211> 205  
 <212> PRT  
 <213> Artificial Sequence

&lt;220&gt;

<223> Description of Artificial Sequence:Pvs28Q130  
fusion protein

&lt;400&gt; 18

Glu	Ala	Glu	Ala	Ser	Lys	Val	Thr	Ala	Glu	Thr	Gln	Cys	Lys	Asn	Gly
1				5					10					15	

Tyr	Val	Val	Gln	Met	Ser	Asn	His	Phe	Glu	Cys	Lys	Cys	Asn	Asp	Gly
			20					25					30		

Phe	Val	Leu	Ala	Asn	Glu	Asn	Thr	Cys	Glu	Glu	Lys	Arg	Asp	Cys	Thr
		35					40					45			

Asn	Pro	Gln	Asn	Val	Asn	Lys	Asn	Cys	Gly	Asp	Tyr	Ala	Val	Cys	Ala
	50					55					60				

Asn	Thr	Arg	Met	Asn	Asn	Glu	Glu	Arg	Ala	Leu	Arg	Cys	Gly	Cys	Ile
65					70					75					80

Leu	Gly	Tyr	Thr	Val	Met	Asn	Glu	Val	Cys	Thr	Pro	Tyr	Lys	Cys	Asn
				85					90					95	

Gly	Val	Leu	Cys	Gly	Lys	Gly	Lys	Cys	Ile	Leu	Asp	Pro	Ala	Asn	Val
		100						105					110		

Gln	Ser	Thr	Met	Cys	Ser	Cys	Asn	Ile	Gly	Ser	Thr	Leu	Asp	Glu	Ser
		115					120					125			

Lys	Lys	Cys	Gly	Lys	Pro	Gly	Lys	Thr	Glu	Cys	Thr	Leu	Lys	Cys	Lys
	130					135					140				

Ala	Asn	Glu	Glu	Cys	Lys	Glu	Thr	Gln	Asn	Tyr	Tyr	Lys	Cys	Val	Ala
145					150					155					160

Lys	Gly	Ser	Gly	Gly	Glu	Gly	Ser	Gly	Gly	Glu	Gly	Ser	Gly	Gly	Glu
				165					170					175	

Gly	Ser	Gly	Gly	Glu	Gly	Ser	Gly	Gly	Glu	Gly	Ser	Gly	Gly	Asp	Thr
			180					185						190	

Gly	Ala	Ala	Tyr	Ser	Gly	Pro	His	His	His	His	His	His	His		
		195					200						205		

&lt;210&gt; 19

&lt;211&gt; 169

&lt;212&gt; PRT

&lt;213&gt; Artificial Sequence

&lt;220&gt;

<223> Description of Artificial Sequence:Pvs28NCR fusion  
protein

&lt;400&gt; 19

Glu	Ala	Glu	Ala	Ser	Lys	Val	Thr	Ala	Glu	Thr	Gln	Cys	Lys	Asn	Gly
1				5					10					15	

Tyr	Val	Val	Gln	Met	Ser	Asn	His	Phe	Glu	Cys	Lys	Cys	Asn	Asp	Gly
			20					25					30		

Phe Val Leu Ala Asn Glu Asn Thr Cys Glu Glu Lys Arg Asp Cys Thr  
           35                                  40                                  45  
 Asn Pro Gln Asn Val Asn Lys Asn Cys Gly Asp Tyr Ala Val Cys Ala  
           50                                  55                                  60  
 Asn Thr Arg Met Asn Asn Glu Glu Arg Ala Leu Arg Cys Gly Cys Ile  
           65                                  70                                  75                                  80  
 Leu Gly Tyr Thr Val Met Asn Glu Val Cys Thr Pro Tyr Lys Cys Asn  
                                   85                                  90                                  95  
 Gly Val Leu Cys Gly Lys Gly Lys Cys Ile Leu Asp Pro Ala Asn Val  
                                   100                                  105                                  110  
 Asn Ser Thr Met Cys Ser Cys Asn Ile Gly Ser Thr Leu Asp Glu Ser  
           115                                  120                                  125  
 Lys Lys Cys Gly Lys Pro Gly Lys Thr Glu Cys Thr Leu Lys Cys Lys  
           130                                  135                                  140  
 Ala Asn Glu Glu Cys Lys Glu Thr Gln Asn Tyr Tyr Lys Cys Val Ala  
           145                                  150                                  155                                  160  
 Lys Gly Pro His His His His His His  
                                   165

<210> 20

<211> 174

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:Pvs25 domain of  
Pvs25-Pvs28 fusion protein

<400> 20

Ala Val Thr Val Asp Thr Ile Cys Lys Asn Gly Gln Leu Val Gln Met  
   1                                  5                                  10                                  15  
 Ser Asn His Phe Lys Cys Met Cys Asn Glu Gly Leu Val His Leu Ser  
           20                                  25                                  30  
 Glu Asn Thr Cys Glu Glu Lys Asn Glu Cys Lys Lys Glu Thr Leu Gly  
           35                                  40                                  45  
 Lys Ala Cys Gly Glu Phe Gly Gln Cys Ile Glu Asn Pro Asp Pro Ala  
           50                                  55                                  60  
 Gln Val Asn Met Tyr Lys Cys Gly Cys Ile Glu Gly Tyr Thr Leu Lys  
           65                                  70                                  75                                  80  
 Glu Asp Thr Cys Val Leu Asp Val Cys Gln Tyr Lys Asn Cys Gly Glu  
                                   85                                  90                                  95  
 Ser Gly Glu Cys Ile Val Glu Tyr Leu Ser Glu Ile Gln Ser Ala Gly  
           100                                  105                                  110  
 Cys Ser Cys Ala Ile Gly Lys Val Pro Asn Pro Glu Asp Glu Lys Lys  
           115                                  120                                  125

Cys Thr Lys Thr Gly Glu Thr Ala Cys Gln Leu Lys Cys Asn Thr Asp  
 130 135 140

Asn Glu Val Cys Lys Asn Val Glu Gly Val Tyr Lys Cys Gln Cys Met  
 145 150 155 160

Glu Gly Phe Thr Phe Asp Lys Glu Lys Asn Val Cys Leu Ser  
 165 170

<210> 21

<211> 196

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:Pvs28 domain of  
 Pvs25-Pvs28 fusion protein

<400> 21

Ala Lys Val Thr Ala Glu Thr Gln Cys Lys Asn Gly Tyr Val Val Gln  
 1 5 10 15

Met Ser Asn His Phe Glu Cys Lys Cys Asn Asp Gly Phe Val Met Ala  
 20 25 30

Asn Glu Asn Thr Cys Glu Glu Lys Arg Asp Cys Thr Asn Pro Gln Asn  
 35 40 45

Val Asn Lys Asn Cys Gly Asp Tyr Ala Val Cys Ala Asn Thr Arg Met  
 50 55 60

Asn Asp Glu Glu Arg Ala Leu Arg Cys Gly Cys Ile Leu Gly Tyr Thr  
 65 70 75 80

Val Met Asn Glu Val Cys Thr Pro Asn Lys Cys Asn Gly Val Leu Cys  
 85 90 95

Gly Lys Gly Lys Cys Ile Leu Asp Pro Ala Asn Val Asn Ser Thr Met  
 100 105 110

Cys Ser Cys Asn Ile Gly Thr Thr Leu Asp Glu Ser Lys Lys Cys Gly  
 115 120 125

Lys Pro Gly Lys Thr Glu Cys Thr Leu Lys Cys Lys Ala Asn Glu Glu  
 130 135 140

Cys Lys Glu Thr Gln Asn Tyr Tyr Lys Cys Val Ala Lys Gly Ser Gly  
 145 150 155 160

Gly Glu Gly Ser Gly Gly Glu Gly Ser Gly Gly Glu Gly Ser Gly Gly  
 165 170 175

Glu Gly Ser Gly Gly Glu Gly Ser Gly Gly Asp Thr Gly Ala Ala Tyr  
 180 185 190

Ser Leu Met Asn  
 195

<210> 22  
<211> 4  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:sequence added  
to enhance cleavage of alpha factor leader

<400> 22  
Glu Ala Glu Ala  
1

<210> 23  
<211> 9  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:sequence added  
to enhance cleavage of alpha factor leader

<400> 23  
Glu Ala Glu Ala Glu Ala Glu Ala Lys  
1 5

<210> 24  
<211> 6  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:polyhistidine  
tag

<400> 24  
His His His His His His  
1 5